Foreign Animal Disease Report

United States Department of Agriculture
Animal and Plant Health Inspection Service
Veterinary Services
Emergency Programs

Number 11:1 March 1983

345
Vesicular Stomatitis [1-3],

Current Events

The vesicular stomatitis outbreak, which has been reported in the last several issues, is continuing in Western and Midwestern States. The disease was confirmed in cattle in Missouri, Oregon, and Kansas, and in cattle and horses in California after November 1, 1982.

Initial cases in California and Oregon may have been introduced by cattle from Idaho. The initial case in Kansas may have been introduced by cattle purchased from a Nebraska livestock sale. The Missouri case was introduced by cattle purchased at a dairy dispersal sale in Colorado. Suspicious cases of vesicular stomatitis during December have primarily involved dairy animals.

Investigations were conducted and samples submitted from premises in States where vesicular stomatitis was confirmed during the period June 2 to December 31, 1982:

State	Total Cases Investigated	Laboratory Results		
		Positive	Negative	Pending
Colorado	415	307	106	2
Wyoming	79	48	31	0
Utah	25	23	2	0
Idaho	132	86	42	4
New Mexico	43	36	7	0
Arizona	13	9	4	0
Montana	29	14	14	1
Nebraska	11	5	5	1
South Dakota	2	1	1	0
Washington	11	2	9	0
California	28	9	13	6
Montana	2	1	1	0
Oregon	7	2	3	2
Kansas	10	2	8	0
Total	807	545	246	16

Investigations of 62 suspicious cases in Arkansas, Florida, Georgia, Iowa, Illinois, Kentucky, Louisiana, Minnesota, New Jersey, New York, North Dakota, Oklahoma, Texas, and Tennessee failed to disclose the presence of vesicular stomatitis. Laboratory tests are continuing on specimens from Colorado, Idaho, Montana, Nebraska, California, and Oregon.
(Dr. W. E. Ketter, 301 436-8091)

100

100

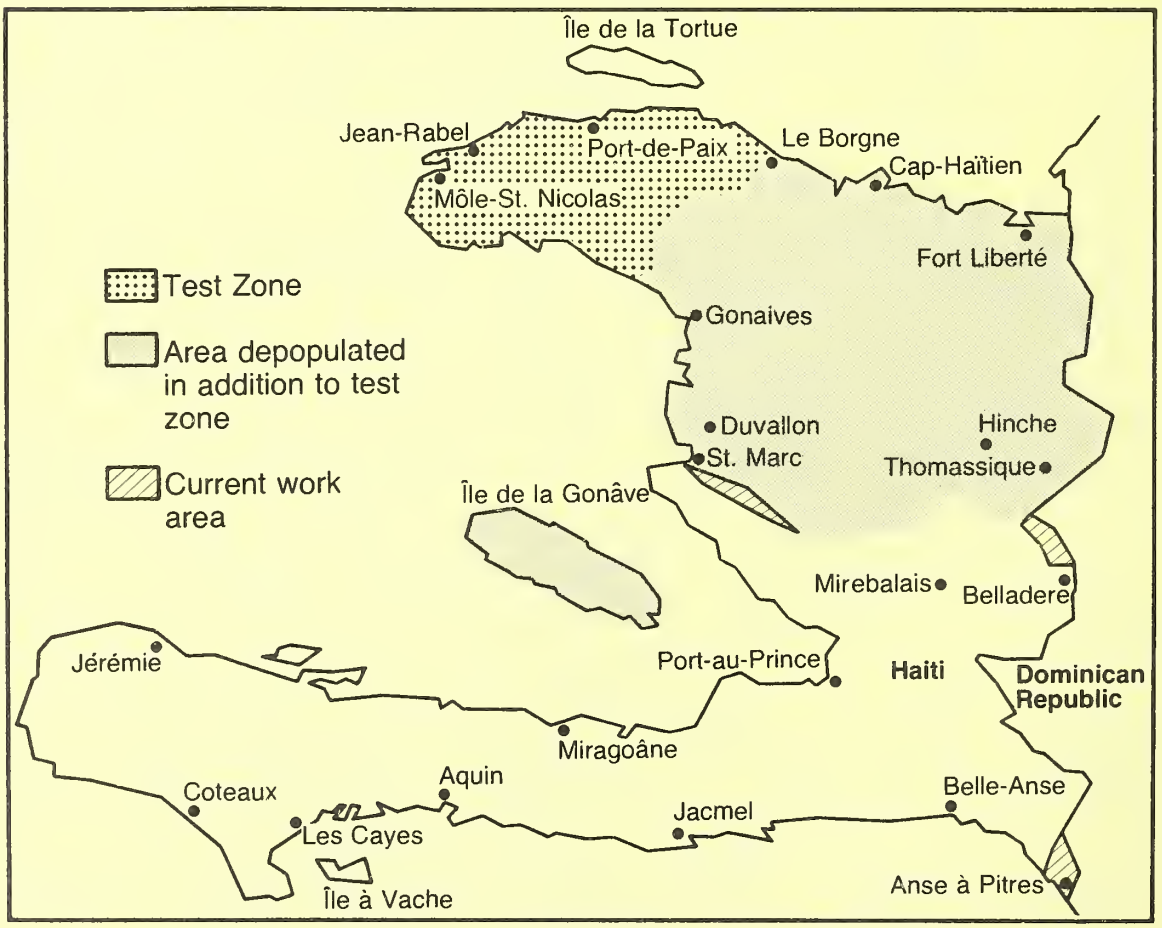
Vesicular Stomatitis Virus in Wild Caught Insects

During the 1982 outbreak of vesicular stomatitis, extensive epidemiologic studies were conducted by collaborating scientists from the Division of Vector-borne Viral Diseases, Centers for Disease Control, Fort Collins, Colorado, and the Arthropod-borne Animal Diseases Research Laboratory, Agricultural Research Service, Denver. Collections of biting and flying insects were made by teams of research entomologists, physicians, and veterinarians; sorted to species; and assayed for the presence of arboviruses.

Isolations of New Jersey (VS-NJ) virus were made from numerous species of flies including Culicoides variipennis (biting gnat), Musca domestica (house fly); Musca autumnalis (face fly); Chloropidae spp. (eye gnat); Anthomyiidae spp. (a muscoid fly), and Simuliidae spp. (black fly). No isolations of VS-NJ virus were made from mosquitoes. The virus isolates were identified by immunofluorescence. Identity of the virus isolated from C. varipennis was verified by scientists at the National Veterinary Services Laboratories (NVSL) as VS-NJ. It produced vesicular stomatitis in calves inoculated by scientists at the National Animal Disease Center (NADC). Studies are in progress to determine whether these fly species are biologic or mechanical vectors. (Agricultural Research Service, T. E. Walton, 303 234-2474; and Centers for Disease Control, P. A. Webb and D. B. Francy, 303 330-6404)

Haitian ASF Update

The cooperative African swine fever (ASF) eradication program in Haiti, reported in the 1982 issues of Foreign Animal Disease



Report (10-1, 10-2, 10-3), is proceeding approximately on schedule with 123,519 head of swine eliminated and $3,243,970 in indemnities paid up to December 22, 1982. Shaded areas on the map show the geographic areas depopulated.

In order to support the Dominican Republic's ASF eradication program and protect repopulation efforts there, four Haitian brigades started working January 5, 1983, from Belladere and two brigades from Anse a Pitres to eliminate all swine from the Haitian side of the border. These brigades will proceed toward Port au Prince. About the middle of January, a front was established at Jeremie on the western end of the southern peninsula. As brigades become available from other fronts, they will reinforce efforts to clear the southern peninsula as rapidly as possible. (Dr. J. A. Downard, 301 436-5256)

For the Record

On January 22, 1981, Secretary John R. Block declared an animal disease emergency based on the continued presence of ASF in Haiti. (erroneously reported as April 29, 1982, in FAD Report 10-1). The Government of Haiti proclaimed a state of emergency April 29, 1982, to facilitate ASF eradication and subsequent redevelopment of its swine industry. (Dr. E. I. Pilchard, 301 436-8087)

World Situation Update

The last quarter of 1982 did not bring any drastic changes in the world situation on animal diseases exotic to the United States, with one possible exception. It was provided, to no one's surprise, by **foot-and-mouth disease (FMD)**. This disease still appears to be the most feared and unpredictable of all major problems afflicting livestock. While the FMD situation in central Europe has stabilized, extensive outbreaks are now reported from the Baltic States within the Soviet Union. However, detailed information is not forthcoming from this region. FMD was reported on a farm in Denmark January 14, 1983, more than 8 months after elimination of the last infected cattle from that country. Elsewhere in Europe, the disease caused many outbreaks in Turkey. For the rest of the world, outbreaks were reported from South Africa, Kenya Uganda, Sudan, Tunisia, Saudi Arabia, India, Iran, Yemen, Bhutan, Hong Kong, Thailand, Bolivia, Brazil, Ecuador, Paraguay, Uruguay, and Peru. Chile considers itself free from FMD and has requested USDA to recognize free status.

Rinderpest was reported from Niger, Uganda, India, and Egypt. The Egyptian outbreak caused some diagnostic difficulties before it could be confirmed.

Contagious Bovine Pleuropneumonia was reported from Angola, Mali, Ivory Coast, Namibia, Kuwait, and France in October 1982. Kuwait and France are the only countries outside Africa reporting the disease. Kuwait probably imports the problem occassionally, as the country depends on imports for much of its protein needs. In France, however, the disease appears to maintain a foothold in the face of extensive eradication efforts.

Dourine, regularly reported from South Africa and Namibia, also resists eradication efforts in Italy, where a few cases are reported almost every month.

Glanders appears to maintain a stronghold in Turkey.

Hog Cholera is reported from many parts of the world including Chile, Brazil, Peru, Colombia, Paraguay, Hong Kong, Japan, Korea, India, Italy, Spain, Portugal, Belgium, Australia, and the Netherlands. The situation in the Netherlands is especially regrettable as the country had high hopes of staying free to benefit from resulting export advantages.

African Swine Fever, reported from Spain, Portugal, and Italy (Sardinia), also invaded Cameroon, with results described as "devastating." Eradication efforts in Haiti are in progress. (Dr. H. J. Seyffert, 301 436-8285)

CEM Update

Italy has been removed from the list of countries designated by USDA to be affected with contagious equine metritis (CEM). Sweden has been added to this list, which includes the United Kingdom, Ireland, France, Belgium, West Germany, Austria, Denmark, Japan, and Australia.

Nine States have been approved to receive stallions imported from CEM countries for additional quarantine, treatment, and testing. These are California, Colorado, Kentucky, Maryland, New York, North Carolina, Ohio, South Carolina, and Virginia.

Six States approved to receive mares imported from CEM countries for additional quarantine, treatment, and testing are California, Colorado, Kentucky, New York, South Carolina, and Virginia.

These States have quarantine and testing requirements in addition to USDA required testing and inspection in the country of origin and at the U.S. port of entry. (Dr. M. P. Dulin, 301 436-8170)

Suspected Foreign Animal Diseases

A total of 49 occurrences of unusual animal disease conditions in 14 States were investigated by specially trained APHIS Foreign Animal Disease (FAD) diagnosticians during the period of October 1, 1982 to December 31, 1982. Involved in the 49 investigations were 33 cattle, 9 horses, 4 pet birds and poultry, 2 goats and 1 pig. (Dr. W. E. Ketter, 301 436-8091)

Exotic Flies

More than 250,000 species of flies (Diptera) are known throughout the world. A low percentage of them are associated with animals, but invasion of animal tissues by larvae (maggots or grubs) and blood feeding by adults causes irritation and tissue damage, and may expose hosts to insect-borne disease agents. Six major insect pests of cattle in the United States, notably the stable fly, house fly, horn fly, face fly, heel fly, and cattle grubs, are introduced species. The potential of re-introducing a seventh has been reduced by cooperative U.S.-Mexican efforts to eradicate screwworms south of the border. Because of their abundance, widespread distribution, and strong flight capability, the threat of exotic diptera to the United States is of constant concern. Two recent events illustrate this condition.

As reported in FAD Report 10-2 (September 1982), a specimen of the European fly, Musca vitripennis, was captured at McGuire Air Force Base, New Jersey, in July of 1982. Larvae of this species develop in cattle manure, and the adults feed on cattle ocular secretions, causing annoyance and vectoring bovine parasites. A team of APHIS veterinarians and Agricultural Research Service (ARS) entomologists surveyed dairy, beef, and pig farms adjacent to McGuire Air Force Base in August 1982 to determine if M. vitripennis was established in New Jersey. Of approximately 60,000 flies trapped, none were M. vitripennis. This suggests it is not established in the area. A followup survey is planned for late spring of 1983.

A second development concerns the Old World blowfly, Chrysomya rufifacies. In its native range in the Australian and Oriental regions, this fly is considered to be a secondary myiasis fly. It has been reported in calves in Hawaii.

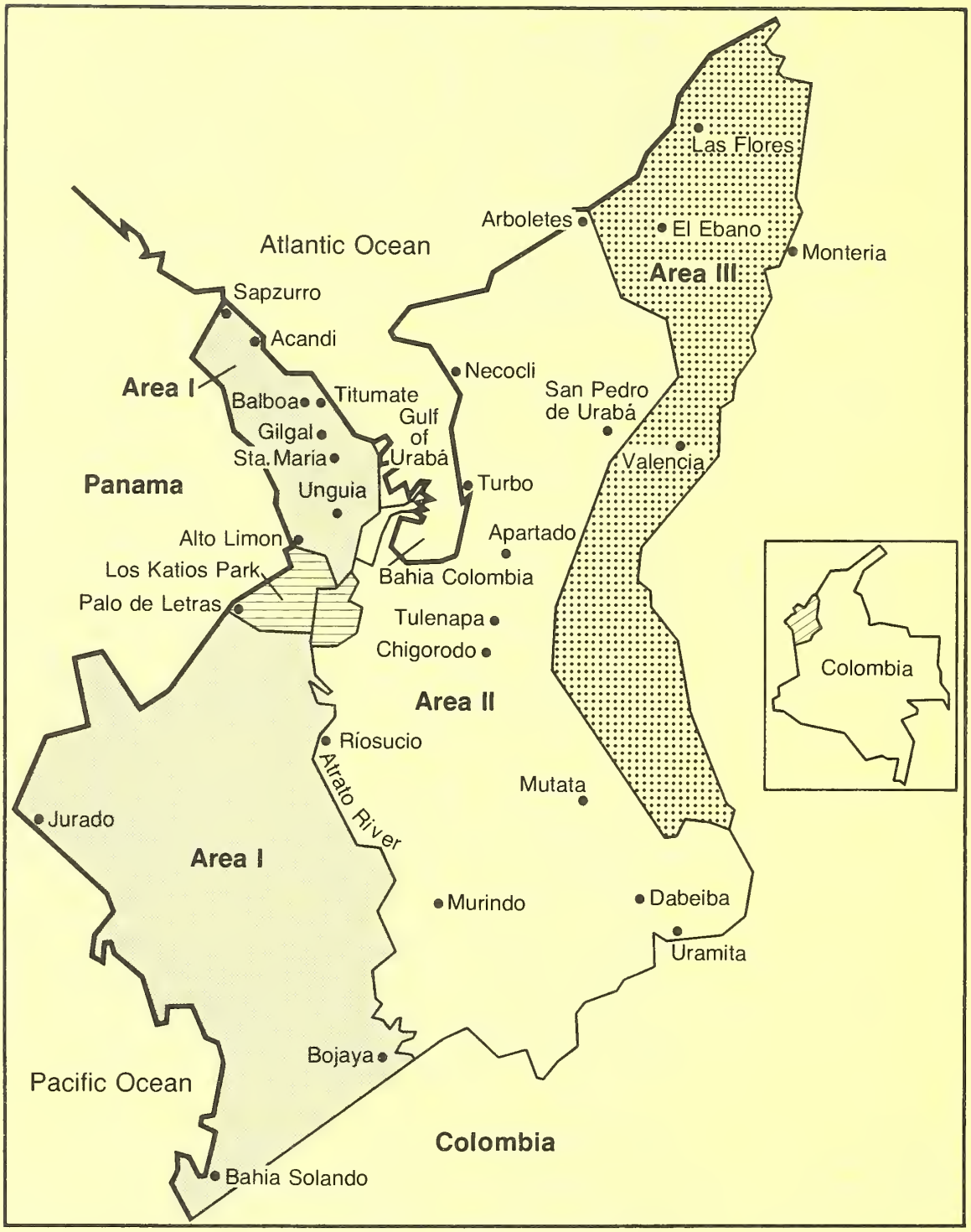
The species was first reported in the Western Hemisphere in Costa Rica in 1978, where it may have been introduced by air commerce. Blowfly larvae are commonly intercepted in animal products at airports. The inevitable dispersal of C. rufifacies in the New World is evidenced by collections of C. rufifacies adults in southern Mexico in 1980 and larval Chrysomya taken from a cow in Durango, Mexico, in June 1981. Further, in September of 1981, the first U.S. larval Chrysomya spp. were taken from a dead cheetah in Brownsville, Texas. Others were found in a dead calf in Frio County, Texas.

In September of 1982, APHIS entomologists R. D. Richard, Ames, Iowa, and E. H. Ahrens, Kerrville, Texas, confirmed that C. rufifacies was well established in the United States. In a survey of north central Texas, 282 adult C. rufifacies were captured in Swormlure baited screwworm traps over an 8-day period. Two U.S. collections of blowfly larvae submitted to the NVSL in October 1982 were identified as Chysomya spp. One of these submissions from Texas and Arizona was taken from living animals. A research program to characterize the biology and economic importance of C. rufifacies in the United States has been initiated by ARS at Kerrville, Texas. (Dr. E. T. Schmidtmann, 301 344-2973; R. D. Richard, 515 232-0250)

ICA-USDA Cooperative FMD Program in Colombia

The first reported outbreak of FMD in Colombia occurred in December 1950 in the eastern plains near the Venezuelan border, and within 10 years the disease had spread to almost all parts of the country. In August 1973, the USDA and the Ministry of Agriculture (MOA) of Colombia signed an agreement for the control and eradication of FMD in the northwestern part of Colombia. This agreement established the three areas illustrated in the following map.

Objectives of the Colombian Agriculture Institute (ICA)-USDA Cooperative FMD Program are to maintain Area I free of FMD, eradicate FMD from Area II, and control FMD in Area III. Accomplishment of these objectives would aid in preventing the dissemination of this disease from Colombia following construction of the Darien Gap segment of the Pan American Highway. Colombian agriculture has been developing rapidly in the zone immediately adjacent to the Panamanian border.



The principal U.S. objective in this program is the protection of the livestock industries of Panama, Central America, Mexico, and the United States. The experience and information derived from this effort would be extremely important should FMD occur again in the United States.

FMD-Free Area

Area I, located in the northwest part of Colombia in the Department of Choco, includes the Los Katios National Park. It is currently free of FMD and has been since May 1974. The area is maintained FMD free by strict control of the movement of all animals and animal products that could be a source of infection to the area.

Offices and control posts are maintained at airports and boat landings in the towns of Sapzurro, Capurgana, Acandi, Titumate, Balboa, Gilgal, Santa Maria, Unguia, Riosucio, Bojaya, Bahia Solano, and Jurado. Five veterinarians are responsible for the program in this area. The supervisory veterinarian is located in the town of Turbo, and the others are in Acandi, Unguia, Riosucio, and Bahia Solano. In addition, there are 51 livestock and control post inspectors and other program personnel.

At present there are approximately 48,000 head of cattle, 11,000 swine, and 1,000 sheep and goats on 1,255 farms in Area I. The use of FMD vaccine is prohibited and all cattle are identified by numbered ear tags, which are color-coded to the various offices of Area I.

All farms in the area are visited monthly to update the animal census and inspect animals for evidence of vesicular disease. In addition, statistically significant numbers of cattle have been tested for FMD antibodies by the virus infection-associated antigen (VIAA) test. Cattle reacting to the VIAA test are sampled by the probang method and osophageal-pharyngeal (O-P) specimens are tested for virus. During 1983, a larger sampling will be carried out. The number of VIAA-positive animals has declined each year and virus has not been isolated.

When a report of a vesicular disease is received or evidence is found on surveillance, the case is immediately investigated. If the condition found is vesicular in nature, the farm and surrounding area are quarantined and samples are sent to the program's vesicular disease diagnostic laboratories located in Tulenapa and Bogota. A diagnosis of FMD from either laboratory would result in the immediate slaughter and disposal of infected and exposed animals. Owners would receive indemnity payments for animals destroyed under the FMD program.

A public information program is carried out to make people more aware that Area I is free of FMD. The information program is structured to teach them what they can do to prevent FMD, how FMD may be controlled and eradicated, and assure rapid detection.

Los Katios National Park

Located within Area I is the 72,000-hectare Los Katios National Park. The proposed route of the Darien Gap Highway will pass through the park from the Atrato River to the Panamanian border. The park was established as a barrier to protect Panama and points north from FMD. The Institute for the Development of Renewable Natural Resources and Environment (INDERENA) is responsible for the park's development, administration, and maintenance.

The park is a joint ICA-INDERENA-USDA project. It is kept free of domestic animals susceptible to FMD, and there are to be no permanent residents except for park personnel. INDERENA is negotiating with current residents of the park to purchase their land and buildings and resettle them outside the park's boundaries. This process is 95 percent complete. Regular surveillance by air, land, and river patrols is necessary to prevent new intrusions by people seeking land on which to settle.

FMD Eradication Area

Area II is located in the northern part of the Department of Antioquia to the east of Area I. It includes the towns of Arboletes, Necocli, San Pedro de Uraba, Turbo, Apartado, Chigorodo, Mutata, Dabeiba, Uramita, Murindo, and the part of Riosucio that is on the east bank of the Atrato River.

The part of Riosucio located in Area II is called the observation zone. In this zone there has never been an FMD outbreak and, therefore, it is attended by the Riosucio office in Area I and is treated as a part of Area I. Program offices in the remainder of Area II are located in the towns of Arboletes, Necocli, San Pedro de Uraba, Turbo, Chigorodo, Mutata, and Dabeiba. A program control post is located at Uramita. Ten program veterinarians are responsible for this area. The area supervisor, the program's epidemiologist, and the laboratory director are at the diagnostic center located at Tulenapa, one of ICA's experimental farms. The other veterinarians are distributed throughout the various offices. There are also 69 livestock and control post inspectors and other program personnel. At this time there are approximately 430,000 head of cattle on 4,710 farms in the area. All farms in Area II are visited every 3 months to update the animal census and inspect animals for evidence of vesicular disease. The program is working towards total FMD eradication in Area II by requiring vaccination of at least 95 percent of the cattle in the area three times a year. This level of vaccination has been maintained since 1977. A large percentage of the vaccinating is performed by program personnel, with the rest being done by the Fondo Ganadero (cattleman's association). The vaccine used since 1979 has been potency tested in cattle. It has been rated good to excellent as measured by bovine 50 percent protective dose (BPD-50), which has ranged from 5 to 12 BPD-50. Vaccination with high quality vaccines has been followed by a sharp decrease in the incidence of FMD in the area. The last clinical case of FMD in Area II was reported in June 1981. An antibody level study is done annually on a statistically significant sample of cattle 90 days after vaccination. Results of recent studies once again confirmed the quality of the vaccine.

The Colombian Veterinary Biologics Company (VECOL), which produces the FMD vaccine, has recently installed equipment necessary for production of oil-adjuvanted FMD vaccines, and a high quality Colombian vaccine of this type is anticipated for use in Colombia in 1983.

In addition to vaccination, animal movements into and within the area are controlled, and there is routine surveillance for vesicular diseases. When a vesicular disease is reported or found during surveillance, it is immediately investigated. If it is verified, the farm and surrounding area are quarantined and samples are sent to one of the program laboratories. All susceptible animals in the quarantine area are immediately vaccinated or revaccinated even before the laboratory results are known. If the laboratory confirms FMD, the quarantine is maintained for 21 days after the last clinical case has appeared. A public information program on FMD is also carried out to make the people more aware of FMD and what needs to be

done to prevent, detect, control, and eventually eradicate it from the area.

FMD Control Area

Area III is the western half of the Department of Cordoba and is located just to the east of Area II. Offices are maintained in Area III in Monteria, Valencia, El Ebano, and Las Flores, and a control post at the Sinu River bridge. Two mobile control units operate out of the Monteria office to control animal movements. There are 5 veterinarians and 34 livestock and control post inspectors and other program personnel in the area.

There are approximately 600,000 cattle in Area III. Each farm is visited twice a year to update the animal census and inspect animals for evidence of vesicular diseases. Specimens are obtained in all vesicular disease investigations to monitor FMD virus types active in the field.

Public information programs on FMD are carried out to encourage more vaccination by owners and reporting of vesicular diseases. FMD vaccinations are expected to be at 80 to 85 percent of the cattle in Area III for the third vaccination cycle of 1983.

Outlook for Cooperative Program

Agricultural development and growth are evident everywhere in the northern parts for the Departments of Choco and Antioquia. Progress is bringing improvements in air and land communication with the rest of Colombia, which means bringing more of a threat that FMD will move into this area.

As long as there is good cooperation from the Government of Colombia, as is now the case, the program should continue and even itensify. It is in the best interest of the United States to accomplish the goals specified in the agreement--to secure Area I, achieve eradication in Area II, and develop an adequate control program in Area III--and thus keep FMD at the greatest distance possible from the free areas of Panama and Central America. It is also important that Colombia increase FMD control activities in areas adjacent to the joint program, especially in the southern part of the Departments of Choco and Antioquia and the eastern part of the Department of Cordoba. Such a commitment on the part of the Government of Colombia is essential to insure that with the normal changes in administration in Colombia, the FMD program that presently exists in the northwest portion of the country will continue to offer an adequate degree of protection for Panama, Central America, Mexico, and the United States. (Dr. J. H. Wyss, Bogota, Colombia: 285-4634)

100

Guarding America's Agriculture

The USDA agency responsible for keeping foreign animal and plant pests and diseases from entering the United States at our ports of entry is APHIS through its Plant Protection and Quarantine (PPQ) and Veterinary Services (VS) programs.

Seven days a week, PPQ officers are on duty at international airport terminals to check passengers and inspect baggage for foreign plant and animal products that could be harboring pests or disease producing organisms. They also inspect air and sea

cargoes, rail and truck freight, and mail from foreign countries.

In fiscal year 1981, agricultural inspectors questioned more than 16 million passengers and inspected about 48 million pieces of baggage. They also inspected 270,000 planes that brought air travelers and cargo to the United States.

During that year, inspectors seized 702,000 regulated agricultural products, and from those seizures intercepted 245,000 kilograms of unauthorized meat and meat products that had the potential to bring disease-producing agents to U.S. livestock.

Agricultural inspectors make sure that airlines handle and dispose of foreign garbage and food waste properly. Safe disposal under federal regulations means sterilization, incineration, or grinding into an approved sewage system.

Many passengers who have visited foreign countries do not realize that one link of homemade sausage or piece of fruit has the potential to cause serious damage to U.S. agriculture.

Meat products from many countries are not permitted into the United States because many organisms that cause animal diseases can live in meat for many months and can even survive some processing. The risk is that certain foreign meat products may not be eaten entirely and scraps put in garbage may be fed to animals and start an epidemic.

In 1978, African swine fever was first identified in Brazil and the Dominican Republic. Garbage fed to swine was the source of the disease in both countries. A widespread outbreak in U.S. swine would drive up the price of pork to the consumer and cost millions of dollars to eradicate, as well as close many U.S. export markets. There are at least 40 other foreign animal diseases that could damage American livestock and severely affect our agricultural economy. If introduced, foot-and-mouth disease could cost the U.S. livestock industry $15 billion in direct and indirect costs, with most of this cost occurring in the first year. The effect on meat and milk supplies and prices for consumers would be catastrophic.

Parrots, parakeets, and other birds can carry exotic Newcastle disease. This disease came in with parrots from South America in 1971 and spread widely in a major poultry-producing area in southern California, eventually striking 1,341 poultry flocks. About 12 million domestic poultry--mostly laying hens--died or were destroyed before the epidemic was eliminated at a cost to U.S. taxpayers of more than $56 million. An exotic Newcastle disease outbreak in pet birds in 1980 resulted in the destruction of 30,000 caged exotic birds at a cost to taxpayers of $2.8 million.

The cost of eliminating exotic Newcastle disease was minimal compared with what it would have cost had the disease become established in U.S. poultry.

The job of inspecting international passenger baggage may soon be made easier with some nonhuman help. APHIS is developing aids to enhance the inspection process, including a machine that detects carbon dioxide gas emitted by agricultural products and a special line-scan x-ray machine.

Another method being tested to increase the efficiency of the inspection process is the USDA's Agriculture Primary Screening Inspection System. PPQ inspectors using this system--based on composite description of travelers likely to be carrying prohibited items--have increased interceptions by 20 percent at sites tested.

Federal veterinarians work to protect America's agriculture. Their responsibilities include making sure that livestock being shipped into this country meet all necessary precautions to keep animal diseases out of our livestock population.

VS veterinarians also insure that animals being exported meet the requirements of the receiving country. This is accomplished in part by supervising the handling and loading of the animals at the embarkation point.

Inspection of passengers and animals goes on night and day, year after year. Few people realize the importance of the task APHIS employees perform in guarding our country from foreign diseases and protecting export markets. Yet, the future of our Nation's largest industry, agriculture, with its assets totaling $927 billion, is at stake.

Inspection procedures--provided for passengers at 85 airports in the country by a total force of 900 PPQ officers--cost American taxpayers approximately $22 million in fiscal year 1980. Based on the total U.S. population of about 226,504,825 (1980 census), that works out to about 10 cents per person. (Adapted from the February 1982 issue of APHIS Facts)

Focus on... Parafilariasis in Cattle

Parafilariasis in cattle, a parasitic infection caused by the nematode *Parafilaria bovicola*, was first recognized as a cattle parasite in Sweden in 1978. The source of introduction was probably Charolais cattle imported from France, as the parasite was also recovered from Charolais cattle imported from France into Canada in 1966.

The parasite is not in the United States and is not known to have been transmitted from the imported cattle to indigenous cattle in Canada.

The parasite--female, 5 to 6 centimeters long, 500 microns wide; male, half that size--causes cutaneous bleedings in live cattle and bruise-like lesions in subcutaneous and intramuscular tissues of affected carcasses. The lesions affect the quality of meat, especially from affected animals 1 to 2 years of age, with an average of 6 kilograms of the good back cuts being condemned.

History and Geographical Distribution

P. bovicola, a filaroid nematode affecting cattle, was first described in 1934 by M. A. Tubangui. Since then, parafilariasis in cattle has been reported from the Philippines, India, USSR, Tunisia, Morocco, French-speaking West Africa, Nigeria, East Africa, Rwanda, Burundi, South Africa, Romania, Bulgaria, France, and most recently from Sweden.

Clinical Signs

Clinical signs are mild and rather characteristic. The female, which lives in the subcutaneous tissue, lays her eggs on the surface of the skin, reaching this position by penetrating the dermis and epidermis. As the female pierces the skin at the neck and back of the bovine, a trickle of bleeding becomes visible for some minutes or even hours.

No signs of discomfort have been noted in animals affected with *P. bovicola*.

Pathology

The subcutaneous lesions on the carcasses of affected cattle look remarkably like bruises caused by handling and transport before slaughter. Acute lesions have an opaque yellow-green appearance. Edematous areas are intermingled with clearer areas with petechiae in the subcutaneous tissue, on the fascia, and in the superficial muscle layers. Chronic lesions have a greenish dirty brown appearance due to eosinophilic infiltration of the inflammatory tissue.

Histologically, lesions show extensive edema with a diffuse infiltration of eosinophilic granulocytes into the subcutaneous and underlying intermuscular and intramuscular tissues. Foci of eosinophilic granulocytes with some lymphohistiocytic cells are found scattered throughout the lesions. Around small vessels, we find the same types of cells, and in the loose edematous tissue small necrotic foci are evident.

There are other nematodes belonging to the *Filaroidea* group that cause tissue lesions in cattle, namely the *Onchocerca* spp. However, in contrast to *Parafilaria*, *Onchocerca* spp. cause neither extensive edema and discoloration of subcutaneous tissues nor intermuscular and intramuscular lesions.

Pathogenesis

The parasites produce nodules, from the size of a pea to a nut, in the superior parts of the body, particularly the head and neck, the withers, the shoulders, and the sides of the body. Several hours after the appearance of the nodule, the female makes an opening about 0.5 to 1 millimeter in diameter on the summit. This releases a flow of blood, which reduces the swelling, producing a string of coagulating blood, 15 to 30 centimeters in length which sticks to the hairs. Generally, the nodules develop rapidly and within a few hours exude blood which coagulates, matting the hair in the region. The bleeding stops within 24 to 48 hours, and another nodule may develop in the vicinity of the first one producing the same sequence of events.

Diagnosis

A serologic enzyme-linked immunosorbent assay (ELISA) test has been developed and evaluated to diagnose *P. bovicola* infection in living animals. Significant diagnositic titers appear approximately 3 months after exposure.

A provisional diagnosis is usually made on clinical signs --cutaneous bleeding points--in endemic areas. However, many bleedings remain undetected and, therefore, an unknown number of infected animals remain undiagnosed.

To help confirm a diagnosis of parafilariasis in cattle, blood (fresh or dried) from a cutaneous bleeding point of a suspicious case should be collected in a suitable container, containing 1 milliliter of 0.85 percent saline solution, and kept cool during transport to the laboratory. The test material should be transferred to a centrifuge tube and centrifugated at 400 gravities for 10 minutes. The pellet should then be examined microscopically for the characteristic eggs containing microfilariae and/or free microfilariae--200 to 300 microns long and 10 microns wide.

Differential Diagnosis

In live cattle, the focal cutaneous hemorrhages resemble injury by thorns, wire, biting flies, or ticks.

Subcutaneous lesions on carcasses of affected cattle resemble bruises due to careless handling and movement during transport to slaughter.

Vectors

Investigations in South Africa have shown that the licking flies Musca xanthomeles, Musca lusoria, and an unidentified Musca species are vectors of P. bovicola. A preliminary research note from India suggests another licking fly, Musca vitripennis, may also act as a vector for P. bovicola.

Most recently Musca autumnalis de Gear (face fly) has been implicated as a natural vector of P. bovicola. The vector M. autumnalis is known in many regions of Europe, but reportly was identified in Nova Scotia on the North American continent in 1952 and has since spread to a belt covering southern Canada and the northern and central United States from coast to coast.

Epizootiology

Vector-borne diseases, such as parafilariasis in cattle, are restricted to certain geographical regions that coincide with those of their vectors. Although the parasite is not presently in the United States, a real threat exists to our beef industry, due to the presence of the biological vector, M. autumnalis. Experimental transmission studies carried out in Sweden demonstrated that face flies obtained from the United States are capable of serving as biological vectors of P. bovicola, as is the European face fly.

No age, sex, or breed preference has been noted in cases of exposure to P. bovicola, although bleeding points are more easily recognized in breeds like the Charolais with its light hair coat and are therefore reported more often. Retrospective studies in Sweden revealed parafilarial lesions at slaughter in 35 percent of the young cattle from herds exposed to face flies on pasture during the year preceeding slaughter. However, parafilarial lesions were not found in cattle from herds managed indoors, indicating exposure to vector face flies on pasture.

There are few condemnation losses in cows at slaughter due to the minimal lesions caused by the parasite in adult cattle.

Lesions caused by the parasite appear in a seasonal pattern in the Northern Hemisphere, starting in December and lasting through the first half of the calendar year, after which they disappear. In the Southern Hemisphere, on the African continent, this reportedly occurs in a reverse pattern in the period from June to January.

The reservoir of infection in Sweden is the infected cow herd, where the presence of infection does not present an economic problem for the farmer, since there are few condemnation losses of cows at slaughter. Direct economic losses exist for producers who have limited their production to raising young bulls and steers. These become infected at initial pasture exposure to vector flies containig P. bovicola infective larvae. At this time the cattle weigh from 300 to 400 kilograms and are 1 to 2 years of age. Three to 9 months later--December through July--the infections result in a large percentage of condemnations and substantial economic losses. However, these animals are not important as reservoirs of infection under the present Swedish meat production system, as they do not normally survive through two subsequent pasture seasons.

The spread of the parasite P. bovicola to new localities may take place several ways. The vector may move actively or passively (livestock trade) to new sites, or the infected bovine may be moved to virginal geographic areas.

Life Cycle

The life cycle of P. bovicola begins when outdoor vector flies feed on the bleeding points of parafilariasis-affected cattle and ingest infective microfilariae (first-stage larvae). These vector flies then become the intermediate host.

After 14 days in South Africa and 20 days in Sweden, the microfilariae develop into infective 3rd-stage larvae. These larvae are infective for cattle on which the vector flies subsequently feed. The developmental period in cattle from the infective 3rd-stage larvae to adult parafilaria is 9 to 10 months under Swedish conditions. This is comparable to the 7-to 10-month period reported from South Africa.

Parafilarial Routes of Entry

Results of experimental transmission studies to calves indicated that 2 out of 5 positive cases were inoculated by the intraconjunctival route, whereas three calves exposed by the subcutaneous route did not develop lesions. This correlates with reported findings that M. autumnalis feeds primarily on eye secretions. However, experimental infections via the subcutaneous, intravenous, and intraconjuctival routes have been reported by others.

Seasonal Occurence

The developmental period of the parasite to sexual maturity is in agreement with the seasonal occurrence of bleeding points starting in February and the seasonal occurrence of slaughter lesions starting in December, a couple of months before the parafilaria reach sexual maturity. Later in the year, only sterile and/or calcified nematodes have been found in healing or healed lesions. Also, 4th-stage larvae from new infections are found. These observations indicate that adult parasites seem to die off after oviposition and do not survive into the next season. This is an important fact when considering parasite control.

Prevention and Control

Elimination of infective P. bovicola from cattle before they leave the exporting country would be the method of choice in preventing the entry of filariasis into the United States. Availability of the diagnostic serologic ELISA test makes possible testing of cattle in P. bovicola endemic area. Cattle on pasture should be tested about 3 months after the pasture season begins. If tested earlier, a retest should be done at least 3 months after the pasture season begins. Seropositive animals should be considered to have been infected with P. bovicola during the previous pasture season. The following recommendations are offered for handling these animals:

1. Keep them stabled for the entire pasture season following their infection.

2. Slaughter seropositive animals, or return seropositive animals to P. bovicola endemic areas.

3. Treat seropositive animals prior to export with an anthelmintic evaluated specifically for its filariacidal effect at P. bovicola bleeding point sites. No such product is presently available in the United States.

For animals to be imported into P. bovicola-free areas such as the United States, but where the vector fly M. autumnalis is abundant, it is strongly recommended to serotest animals in the country of origin before allowing them to enter. Specific guidelines regarding live animal trade between endemic and P. bovicola-free areas have been developed in Sweden. Guidelines are constantly being updated as changes in the disease situation occur.

Research

More research is needed in the areas of 1) vector control as a method to control P. bovicola, 2) evaluation of drugs for efficacy in the prevention of bleeding points and carcass lesions, and 3) diagnostic tests. (Dr. Steen Bech-Nielsen, the Ohio State University, 614 422-1206)

100